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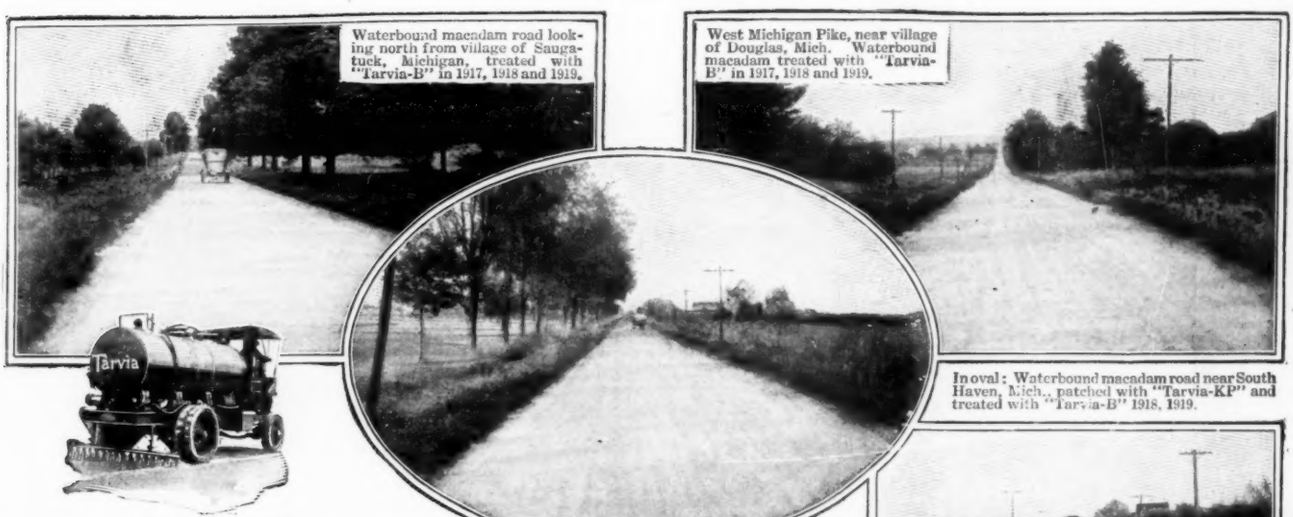
PUBLIC WORKS.

CITY COUNTY STATE

A COMBINATION OF

"MUNICIPAL JOURNAL" and "CONTRACTING"



Waterbound macadam road looking north from village of Saugatuck, Michigan, treated with "Tarvia-B" in 1917, 1918 and 1919.

West Michigan Pike, near village of Douglas, Mich. Waterbound macadam treated with "Tarvia-B" in 1917, 1918 and 1919.

Inoval: Waterbound macadam road near South Haven, Mich., patched with "Tarvia-KP" and treated with "Tarvia-B" 1918, 1919.

West Michigan Pike, Van Buren County, Michigan. Waterbound macadam roadway treated with "Tarvia-B" in 1918 and 1919. Part of a 15 mile stretch of Tarviated roadway.

Tarvia will save the country's roads—

All over the United States there are thousands of road commissioners facing the prospect of having to build new roads at the present high cost of construction.

And all around them are miles and miles of old gravel and macadam roads, not in themselves equal to traffic conditions, but which can be made serviceable if they are repaired and given a Tarvia treatment.

Some Michigan roads, illustrated herewith, show how easily and economically old roads can be salvaged with Tarvia.

One road, for instance, was so bad that the Township Board decided the only thing to be done was to rebuild it at the cost of a new road, but after seeing results obtained on other roads, decided to patch and treat with "Tarvia-B" and stone chips, and—*"the road is better than when new,"* they say.

Tarvia is a coal-tar preparation for restoring old roads and building new ones. With it you can also widen your narrow roads by adding Tarvia macadam shoulders. It provides a smooth, dustless, mudless, waterproof, traffic-and-frost-proof roadway at moderate first cost and with the minimum upkeep expense.

"Tarvia-KP" is a cold treatment for patching existing roads of every type. It fills up worn places, restores broken shoulders and edges and keeps the road always at the top-notch of condition.

Let our engineers advise you how to salvage your old roads with Tarvia, at very attractive costs.

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Tarvia

Preserves Roads-Prevents Dust

SPECIAL SERVICE DEPARTMENT

This company has a corps of trained engineers and chemists who have given years of study to modern road problems. The advice of these men may be had for the asking by anyone interested. If you will write to the nearest office regarding road problems and conditions in your vicinity, the matter will be given prompt attention. Booklets free.

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PUBLIC WORKS.

CITY COUNTY STATE

A Combination of "MUNICIPAL JOURNAL" and "CONTRACTING"

Vol. 49 FLORAL PARK, AUGUST 14, 1920 No. 7

State Highway Maintenance in New York

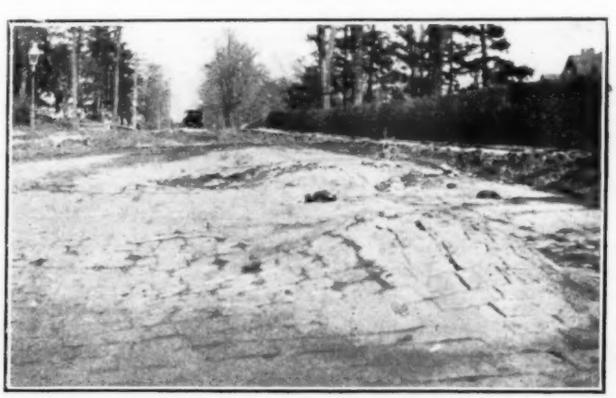
Exceptionally heavy truck traffic during an unusually wet spring resulted in the total destruction of thousands of feet of high-grade bituminous concrete and asphalt block on the highways north of New York City. How temporary repairs, and later permanent ones, were made by the state highway forces is described in this article.

Probably as difficult a maintenance problem as is to be found in the State of New York is that presented to the engineers of the first division, extending along the Hudson river from New York up to a point a few miles south of Albany, and extending from the state line on the east to a western limit 20 to 40 miles west of the Hudson river. This includes the main highway which carries all of the traffic from New York north to Albany and a considerable part of that going into New England as well, while on the west are the routes followed by automobiles going from New York and New Jersey into the Catskill Mountains and the country west of the Hudson. In addition, there are many miles of less traveled highways and of roads connecting the farming sections with the main highways, but the problems presented by these are not unusually difficult ones. The total mileage being maintained approximates 1,300 miles.

The traffic of the main highway paralleling the east side of the river has always been heavy, and this highway has been improved from time to time until practically all of it is of bituminous concrete, with a small amount of cement concrete. Like most old highways in the east, this had begun as a water-bound macadam road, and the bituminous concrete surface which has been laid during the past 10 years has in almost every case been built upon the old macadam as a base. With the greatly increasing weight and number of vehicles using the road, the construction has been made heavier from year to year and condition improved. It was realized, however, that at some points the old macadam base was not sufficiently heavy and did not furnish so high a factor of safety for carrying this traffic as was desirable. This spring unusually trying conditions resulted in the factor of safety being exceeded in a number of places and in the almost total destruction of many short strips of road and the formation of numerous pot holes in other sections. This should not be considered as being in any way to the discredit of the highway department, since the conditions were so unusual and, even had they been anticipated, it would not have been possible to have undertaken the extensive reconstruction work necessary to meet them because of the scarcity of labor and materials and even of funds for the work during the several years previous.

The unusual conditions referred to were those of both weather and traffic. The ground remained wet much longer than usual this spring and in fact the unusual frequency of rains up to the present time has prevented it from drying out as thoroughly as it usually does. The traffic situation was even more unusual. Owing to the freight embargoes, strike and other reasons, every truck available in New York and New

BITUMINOUS MACADAM NEAR MONROE
TEN-FOOT BANK ON THE LEFT.



ASPHALT BLOCK ON BOSTON POST ROAD.

England was used for weeks during the latter part of March and in April for carrying all kinds of freight between New York and the north. Probably as many as 2,000 trucks a day passed over this road, many of them weighing 5 to 8 tons. In fact, the engineers time and again saw as many as 12 to 14 rolls of news print paper on a single truck, each roll weighing about 1,300 lbs. giving a load of 15,000 to 18,000 lbs. in addition to the weight of the truck.

These trucks began operating over this road before the snow was gone and while the ground was still quite wet, and before long the soft spots in the subgrade made themselves evident by the wheels breaking through the pavement. The Highway Department immediately turned all their facilities onto the work of repairing these breaks as fast as they formed. Before the end of March they were operating all of the trucks owned by the department in this division and by the middle of April there were engaged in this work 40 state-owned trucks and 40 rented trucks, the former being 3-ton Packards or 2-ton Nash Quads, while the rented trucks were mostly half-ton or one-ton trucks of different makes. As many men were employed as were obtainable, reaching 500 to 700 in June.

The breaks were so numerous and frequent during this period that no time was given for making permanent repairs but up to the latter part of April all repairs were temporary only. In most places where the pavement broke through it was found that the clay below was soft for a foot or more. In raising a truck out of one of these mud holes the pavement around it was usually more or less broken, and in some cases 10 or 20 feet of pavement was crushed down into the soft sub-base before the truck could be gotten onto a part solid enough to sustain it. As soon as the truck had been removed, temporary repairs were made to permit traffic to move, there sometimes being from 20 to 50 trucks held up behind the one which had been stalled.

The temporary repairs consisted generally of filling the hole with anything available, stone walls along the road being the material most commonly used. The stones found in the walls in this section are mostly rather small and easily broken, so that a little hand sledging was all that was necessary to place them in shape for use. The stones having been driven into the sub-base as far as possible and brought up to a point two or three inches below the surface, they were covered with cinders which were packed down by the traffic, new cinders being added from day to day as required. The cinders were obtained form manufacturing plants in the nearest city and no charge was made for them. In perhaps the majority of cases, however, the farmers rendered bills for the stone walls used in these repairs.

After four or five weeks of this work there was a let up in this condition, probably both because the ground was beginning to dry out a little and also because most of the weak spots had been broken through. As soon as teams and men could be withdrawn from this temporary work, permanent repairs were begun and have been continued until, at the time of this writing (July 20) only two or three stretches remain to be completed, and these will undoubtedly be out of the way early in August.

These permanent repairs consist of patches from 1 foot square to stretches 800 feet long and the full width of the road, there being many from 50 to 150 feet long. In making the permanent repairs, the old cinders and stone were removed, until solid soil was reached. In some places the traffic over the temporary patches had driven the stone into the soil to a depth of three feet below the surface.* The bottom of the excavation was usually then covered with 6 inches of gravel, the chief object of which was to prevent the clay from being forced up into the sub-base. This was followed by 12 to 30 inches of sub-base stone carried up to within 6 inches of the surface, this by 3 inches of old macadam as an evener course, and the repair finished with a 3-inch surface of bituminous material.

Most of the wearing surface used has been cold patch material, because of the convenience of using this for small and scattered patch work; but where a repair job is more than 100 to 150 feet in length, hot bitumen is preferred, partly because it is quite a little cheaper. However, owing to the difficulty of obtaining materials, the department this year is using what it can obtain even though it may not always be what it would prefer.

In connection with the rebuilding of these sections of pavements, in a number of places subdrains were placed, either tile drains or french drains, gutters were deepened and such other methods employed for draining the sub-base as were practicable considering the funds, men, material and time available for getting the road in condition.

At present the motor traffic is not so heavy as it was during March and April, but there are still perhaps 1,000 trucks passing over the road each 24 hours, a large percentage of these being quite heavy. On the part of this highway nearest to New York City most of the truck travel is at night, the trucks preferring to reach New York early in the morning, unload and load during the day, and start out again in the late afternoon. Thus there is comparatively little truck travel between 9 or 10 o'clock in the morning and 4 o'clock in the afternoon, but from 4 on until the following morning the trucks come in a continuous procession, the larger percentage traveling north during the first half of the night and south during the latter half. Owing to this condition, there would be little advantage in making repairs at night rather than during the day, but all of the work has to be done while this intense traffic is maintained.

Between Wappinger Falls and Fishkill, Poughkeepsie and Rhinebeck, and Hudson and Kinderhook was found most of the damage done to the road this spring and it is estimated that the sum of all the stretches repaired would total about two miles and the cost of making these

*See front cover of last week's issue.

repairs has been between $25,000 and $30,000 per mile.

For the regular maintenance the department used the patrol system to a large extent until this year, but this system has been practically abandoned except for a few isolated roads. Instead, the roads are now maintained by small gangs known as section gangs, in addition to which there are used in the division about 25 gangs for heavy work, which are sent wherever they are needed.

Each section gang has its own section of about 15 or 20 miles to maintain. Each gang consists of a foreman and from 4 to 7 men or sometimes as many as 10. The foreman provides a half-ton or a one-ton truck for which the State pays him a rental. This truck carries the picks and shovels, tamping tools and other hand tools as well as the men. Stone is placed in piles along the side of the road by special trucks so that the section gang trucks have to carry this material for only short distances. Barrels of bituminous materials also are kept on hand at intervals along the road. The State Comissioner is especially insistent that the piles of stone shall always be kept neatly shaped up, both because this tends to prevent the stone from being scattered and lost and also for apparance' sake. These section gangs do the regular maintenance, making small patches, cleaning out ditches, etc.

Where there is need for renewal work rather than patching, one of the heavy gangs is used. These gangs utilize the two-ton and three-ton state trucks, from one to three trucks being attached to each gang and from 10 to 40 men. A large part of the repair work is done with cold patch material, but the renewal work is largely hot mixed asphaltic concrete, and these heavy gangs are provided with the appliances necessary for constructing such pavement. The road rollers used are in some cases owned by the State and in others are hired for the purpose from local contractors or municipalities.

NEW CONSTRUCTION

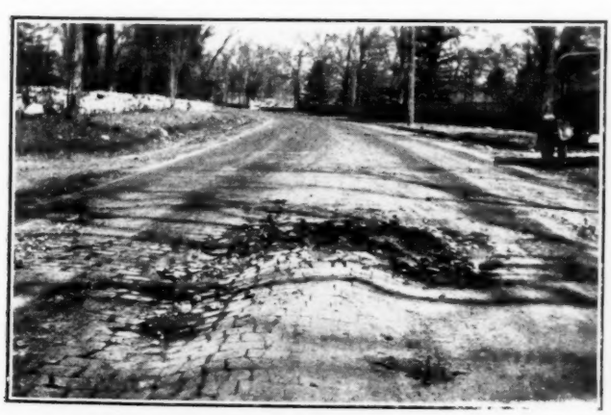
Comparatively little new work is being laid this year, only about 10 of such contracts now being under way, although there are about 30 contracts under construction which have been continued from last year, while about 15 of last year's contracts have been abandoned.

BITUMINOUS MACADAM ROAD NEAR NYACK

Although the high prices of materials and labor have undoubtedly tended to restrict the amount of contracts let, the chief reason has been the lack of contractors to bid upon the work. In December of 1919, 13 contracts were advertised but bids were received on only 9, and on only 5 was there more than one bid. In January of this year 22 lettings were advertised, bids were received on 13 and two or more bids on only 6. In March 21 were advertised, 14 were bid upon and 6 received more than one bid. Most of the large contractors already have contracts carried over from last year, and probably the scarcity of both labor and material and the uncertainty of price movements have had considerable to do with the lack of bidders.

Both labor and material were very scarce during the spring but conditions with respect to both have now improved somewhat.

In this division sand can be obtained at comparatively short distances from most contracts. Stone can be obtained from New England quarries, being brough in coal cars returning otherwise empty to the mines. In sections of the country, however, where mines and quarries both lie in the same direction from the work under construction, it is impossible to obtain permission from the government to use open-top cars for hauling stone. At present there is considerable difficulty in obtaining cement, partly because of the scarcity of freight cars for transporting it and partly because the cement companies are not able to secure all the coal needed for manufacturing it. In general prices are from 15 to 20 per cent higher in this division than they



ASPHALT BLOCK ON BOSTON POST ROAD

ASPHALT BLOCK ON CONCRETE—BOSTON POST ROAD.

were in 1919 and over 100 per cent higher than they were three years ago.

About 75 per cent of new work that has been let this year is concrete, all of it reinforced. The standard road bed is now 16 feet wide, although 18 feet or even 20 feet will probably be adopted where possible in the future. For 16 feet width the concrete is made 7 inches thick in the center and 6 inches thick on the sides. The old macadam road which concrete replaces is scarified and the loose material surfaced and rolled with a 10-ton roller. It is necessary to scarify the old road in most cases because the crown is considerably higher than is desirable for a concrete pavement. The reinforcement regularly employed is specified to consist of main members having a cross-sectional area of not less than .06 square inch per lineal foot of road and spaced not more than 6 inches apart, while the tie members are not more than 12 nor less than 8 inches apart; the two sets of members being placed at right angles and the total reinforcement weighing not less than 25 lbs per hundred square feet.

At at least two points between New York and Buffalo it is planned to construct a pavement 24 feet wide consisting of two 9-foot strips of concrete with a 6-foot strip of bituminous concrete in the center. One such section west of Albany was begun last year, one of the 9-foot concrete strips having been constructed.

All work in the First Division is in charge of James H. Sturdevant, division engineer. Maintenance is in charge of E. J. Howe, resident engineer in charge of maintenance. The writer is indebted to both of these for information, photographs and other courtesies extended to aid him in the preparation of this description.

Hartford, New Jersey, Sheet Asphalt Mixing Plant

Contractor's central installation with capacity of 3,000 square yards daily of binder and surface courses hauled hot to a maximum distance of 10 miles.

The completion during this year and next year of about fifty miles of sheet asphalt highways in the county of Burlington, N. J., will provide there a total of 60 miles of waterbound and oil-treated macadam roads from 14 to 16 feet wide which have been converted, generally on the old foundations, to asphalt pavements from a standard of 18 feet to a maximum of 30 feet in width.

This improvement will have involved laying about 500,000 yards of binder and top course having a combined thickness of 3 inches, all of which will have been mixed in a central plant installed by the Union Paving Company, contractor, at Hartford, Burlington County, N. J.

At the plant, which is of a semi-permanent character, there is always maintained in storage at least 1,000 tons of sand from the Norcross & Edmonds pit at Birmingham, N. J., where it is excavated by a steam shovel and delivered to railroad cars after the 6 or 8 inches of loam has been stripped from the surface of the sand deposit. The excavating shovel works on a face from 8 to 20 feet high, and loads from twenty to forty 40-ton cars daily. The cars are hauled about twelve miles to the asphalt plant and are unloaded by a locamotive crane with 65-foot boom and 1-yard clamshell bucket which will handle two cars per hour.

The broken stone, from Lambertville quarries, is shipped in cars and, like the sand, is unloaded and stored at the plant in 1,000-ton piles. From these piles, sand and stone are transferred by the locomotive derrick to a 40-ton hopper-bottom bin delivering to a 6x30-foot Coatesville drier equipped with two fuel oil burners. An electric pyrometer at the outlet automatically maintains a constant temperature of about 500 degrees in the sand discharged there. When the moisture of the sand does not exceed 10 per cent, the capacity of the drier is from 30 to 35 tons of sand per hour.

From the foot of the drier, the sand is delivered at a temperature of 500 degrees to the boot of a bucket elevator 30 feet high, which originally deposited the sand in a large storage bin. This arrangement was, however, found to be wasteful of heat and the large bin has been eliminated and the hot sand is now chuted directly from the elevator to a second auxiliary elevator which fills a 20-ton bin which supplies by gravity the weighing hopper at the mixer.

The drier is operated alternately on sand and stone, the latter being heated to from 300 to 325 degrees and elevated and delivered through protected chutes to the 50-ton storage bin that supplies the mixer.

From 100 to 120 tons of limestone dust, shipped by rail in 100-pound bags, is kept in storage, and as required the bags are emptied by hand into the boot of a bucket elevator delivering to an elevated storage bin adjacent to the hot stone and sand bins.

The asphalt, delivered in 25-ton and 40-ton standard gage tank cars, is heated in them by

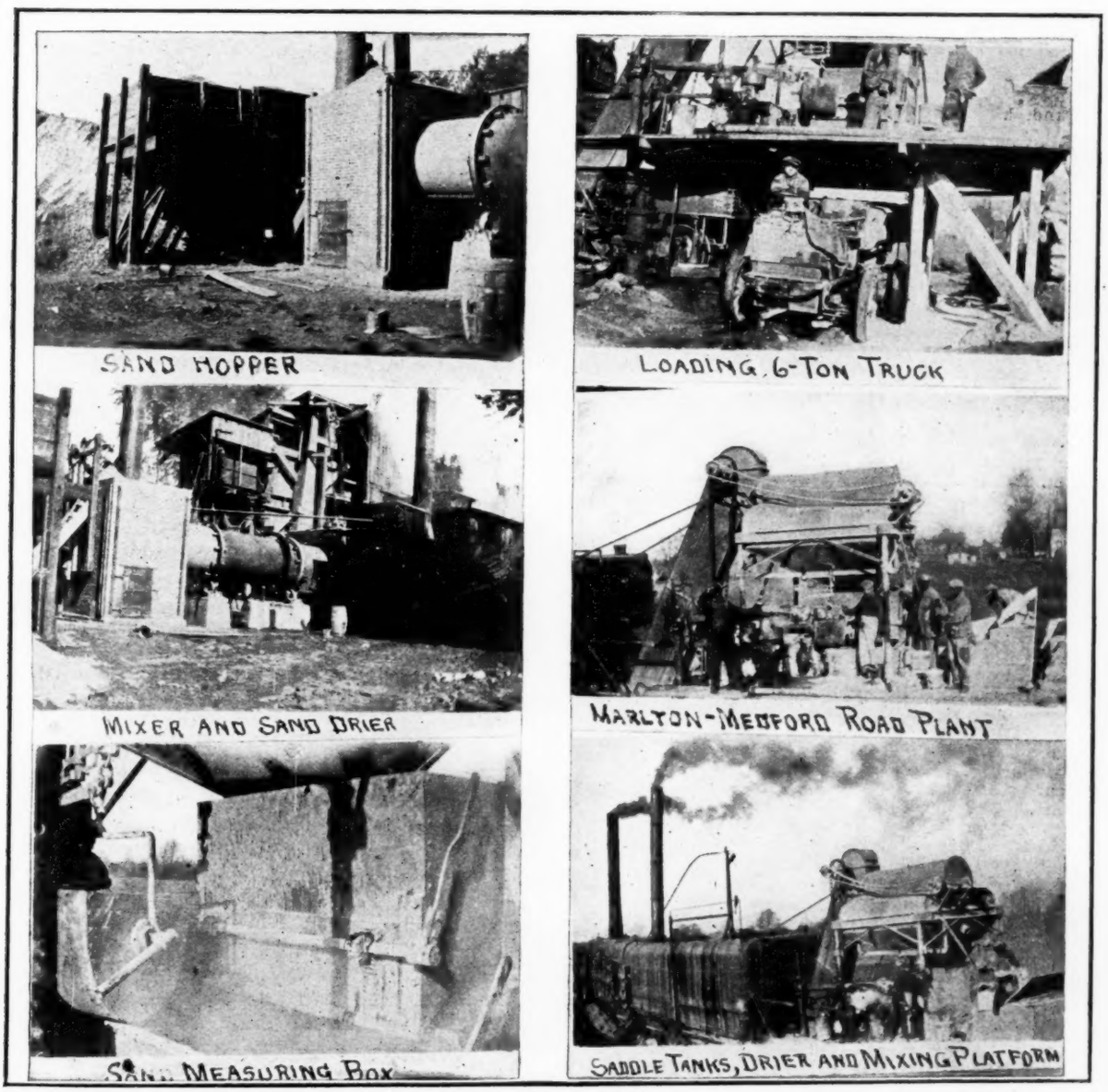
steam for 24 hours until it is sufficiently liquified to be pumped by air pressure into two 50-ton tanks furnished with steam coils which maintain the temperature of the asphalt there at 300 degrees. From these tanks the asphalt is again elevated by an air lift to an overhead draw-off still, whence it flows by gravity to the mixing platform and is drawn as required into a 200-pound trolley bucket passing over the weighing scales to the charging hopper.

Below the mixing platform there is installed a 15-cubic foot capacity Iriquois pug mill type of mixing machine elevated 12 feet above the surface of the ground and capable of turning out a 2,000-pound batch of binder or top course in from 50 to 90 seconds.

For making the binder course, the proper amount of hot stone is first drawn into the weighing hopper and weighed, then hot sand is weighed into it, and finally the proper amount of asphalt is added and the whole is mixed and discharged by gravity into a truck on the ground below.

For making the top course, sand, stone and dust and asphalt are successively weighed into the hopper, mixed and discharge like the binder course.

The plant, which has a capacity of 3,000 square yards of 3-inch asphalt pavement in 10 hours, is operated by a total force of about 20 men, under the supervision of H. B. Smith, resident engineer, of the firm of Dow & Smith, consulting highway engineers, which since 1916, has inspected the asphalt for about 500,000 square yards of sheet pavement built for James Logan, engineer of Burlington county. The asphalt plant is installed, owned and operated by the Union Paving



MACHINERY AND OPERATIONS AT CENTRAL ASPHALT MIXING PLANT
Marlton-Medford and Saddle Tank views are of a portable plant with capacity of 1800 yards daily.

DAILY REPORT OF INSPECTOR AT PLANT
County of Burlington, N. J.

Plant of Union Paving Co.

Street: River Road From: Union Landing Road To: Pompestan Creek

Foundation: Re-surfaced Macadam Binder: 1½ in. Surface: 1½ in.

No. of Boxes of Binder: 114 Equivalent to: 1208 sq. yds.

No. of Boxes of Surface: 188 Equivalent to: 1992 sq. yds.

ASPHALT CEMENT

	ASPHALT	FLUX	PENETRATIONS
Kind and No.:	Atl. Ref.	....	48
Binder:	100 lbs.	....	....
Surface:	100 lbs.	....	....

BINDER

	STONE	SAND	ASPHALT CEMENT
Box Weights:	1205	315	80

SURFACE

Sand, kind and proportions: Norcross & Edmunds.

Filler, kind and proportions: Limestone.

FORMULA	SAND	STONE	FILLER	ASPHALT CEMENT	TOTAL	% BITUMEN
Box Weights:	1205	....	215	180	1600	11.2

	TIME	SAND & STONE SIFTINGS							TEMPERATURES		
	SAMPLED	200	100	80	50	40	30	20	10	8	SURFACE
Hot Sand:	7:00 A.M.				Binder						290
Hot Sand:	10:00 A.M.										275
Hot Sand:	2:30 P.M.	1	16	10	26	14	11	11	10	1	315
Hot Sand:	4:20 P.M.										300

Remarks: Laid June 19, Binder 1720; Top 1440.

Report No. 31 June 22, 1920 H. B. Smith

Samples of Paving Materials from Plant of Union Paving Company, Hartford, N. J.

REPORT OF ANALYSES

Analysis No. 17928—Asphalt Cement No. 31 Burlington Co., N. J., River Road 6-22-20, Atl. Ref. 100-0.

Analysis No. 17929—Surface Mixture No. 31. Burlington Co., N. J., River Road, 6-22-20, 1205-215-180.

Analysis No.	17928	17929
Penetration of A. C.....	50	
Penetration of A.C. at Plant	48	
Ductility	100+cms.	
Fixed Carbon	16.0%	
Mineral Matter	0.1%	
Organic Insoluble	0.1%	
Bitumen	99.8%	11.5%
Passing 200 mesh		10.5%
Passing 100 mesh		16.0%
Passing 80 mesh		11.0%
Passing 50 mesh		17.0%
Passing 40 mesh		13.0%
Passing 30 mesh		7.0%
Passing 20 mesh		6.0%
Passing 10 mesh		8.0%
Total	100.0%	100.0%

Remarks

No. 17928: This is a good quality Mexican asphalt cement suitable for paving purposes, and complies with the requirements of the specifications.

No. 17929: This is a satisfactory mixture and complies with the specification requirements.

DOW & SMITH.

Copies to Messrs. Logan, Gage and H. B. Smith

Company which maintains there a small field laboratory for testing samples of all materials mixed and all shipments received.

The resident engineer makes daily reports of analysis of the paving materials and the inspector makes daily reports of the amounts of binder and top course mixed, together with proportions of mixture, and the size and temperature of sand as recorded 4 times a day.

The road program of the state of Maine contemplates the expenditure of $4,000,000 and the ultimate completion of an 880 mile system of macadam roads. A $2,000,000 highway bridge from Portsmouth, N. H., to Kittery, Maine, was opened for bids early this month.

The State Highway Department of Pennsylvania on June 15th and 16th received bids for work on twenty-one different sections of road, but announced a month later that all but seven of these had been rejected, most of these seven being projects for borough streets in which the borough concerned will join in the payment. This

is explained by the department as due to scarcity of material and even more because of inability of contractors to secure shipments of material, wherefor additional awards would only create further demands for materials and increase these difficulties.

Regulating Traffic in Wilson

Situated in the very heart of the rich tobacco region of North Carolina, the small city of Wilson probably has more automobiles in proportion to its population than any other city in the southeast—possibly in the entire east. In this center of a region where, for the past few years, money has been so plentiful that the appetite for automobiles and other up-to-the-minute devices for spending money has been almost insatiable, the problem of traffic control was a real one. Fines had little effect; accidents were numerous.

Some months ago a new scheme was adopted. "Stop" lines were painted at every street intersection, on each street at the building lines of the intersecting street. This was merely a white line, broad and heavy. At this line every car or other vehicle is required to come to a full stop, before proceeding across the intersection, whether making the turn or going straight ahead.

At first it was feared that congestion might result, but this was not the case, though some very heavy traffic has been handled. Among the advantages of this system are the complete protection of the pedestrian, since every car comes to a stop, and the practical elimination of all crossing accidents. Another result has been the material reduction in speeding offenses, since it is very difficult to get up to an illegal speed between crossings. The enforcement of this is very easy, as the determining factor is not speed, carelessness or right of way, but merely the making of a full and complete stop at the line.

According to the chief of police, traffic accidents and arrests for violations of traffic law have been reduced 50 to 70 per cent, while accidents to pedestrains crossing at the regular crossings have been virtually eliminated. So satisfactory has this system been, that other towns nearby are putting it in force.

Kansas City Wants Water Works Improvement

Kansas City is in urgent need of an improved and enlarged water supply, but finds itself financially unable to obtain it because of the debt limit imposed by the state laws. A campaign has been begun to secure an amendment to the constitution permitting the city to issue bonds up to 10 per cent of the total property valuation instead of the present limit of 5 per cent. The amendment also would permit the city to issue bonds against the water works property up to 20 per cent of its value, which value is estimated at about $20,000,000.

Unless this amendment passes it is not apparent how the city can possibly carry on the work which is needed and the cost of which is estimated to be about $6,000,000. One suggestion made is that the municipal plant be turned over to a corporation, which corporation could bond the plant (this being permitted by private companies), make the improvements, and then turn the plant back to the city. Whether the courts would permit this method of evading the intent of the law might be questioned.

Field Stones for Concrete Roads

Work was started in 1919 on a concrete road between Reno and Carson City, Nevada, a section of the Lincoln Highway, in connection with which there developed great difficulty in securing aggregate. In fact, the contractor was able to obtain only sufficient for 900 feet of road and then abandoned the contract.

The work was then taken over by state highway engineer, C. C. Vottrell. His first step was to endeavor to solve the problem of aggregate supply. The state arranged to purchase the output of a crushing plant and quarry owned by the city of Reno, reorganized work at another quarry which had been operated by the original contractor, and also operated the county quarry. These three sources enabled them to obtain sufficient aggregate to finish a little over two miles of road before work was shut down for the winter.

In February, 1920 the bondsman of the original contractor employed another company to complete the work on a cost-plus-percentage basis, the state agreeing to furnish all the aggregates, which work was placed in the charge of J. A. Bishop. Under Mr. Bishop's direction, two portable crushing plants were installed at various places along the route of the new road, and bowlders and niggerheads which had been placed along fences and stored in piles on ranches along the road were collected by state trucks and hauled to the crusher. The crushers were located sometimes in the right of way of the road and at other places in the fields nearby. The crushed stone was hauled to stock piles scattered along the road at intervals in no case exceeding half a mile. Two crushers are being used with a maximum daily capacity of about 60 cu. yds. and an average output of about 50 cu. yds. One foreman is in charge of each crushing plant, with four men feeding the crusher, one man running the tractor which furnishes the motive power, five men loading bowlders into the truck to be hauled to the crusher, and five men drilling and breaking over-size rocks. At one plant two trucks are used to haul bowlders to the crusher and four trucks to haul crushed rock to the stock piles; while at the other plant one truck hauls bowlders and three haul crushed rock. The maximum haul from the crusher to the stock piles is two miles.

This is the first concrete highway in Nevada and the State Highway Department and the contractor are endeavoring to make it a first class job. 1:2:4: mix is used. The road is about 5½ miles long and 18 feet wide.

Constructing Water Supply Works of Winnipeg*

By W. G. CHASE, Chief Engineer, Greater Winnipeg Water Works

Foundations in difficult ground. Heavy inverts for gravity stability, and general invert construction. Arch construction. River Crossing. Trench Work.

FOUNDATIONS

The material encountered in this hundred miles of trench work varied all the way from peat to rock, including soupy clay, waxy clay, the various intermediate mixtures of clay and sand, dry or under water pressure and quicksand, granite and trap rock. By care in location but little rock excavation was necessary anywhere. Each class of soil found at invert grade presented a separate and distinct problem in the effort to obtain a highly resisting trench floor. Dryness was a prime essential and was generally obtained by the methods described above.

Soupy clay was made firm by casting into it broken stone of varying sizes, mostly of rip rap dimensions.

Quick sand was excavated below grade between lines of sheet piling, a layer of stone and gravel was superposed and within this layer the box drain was maintained at its proper grade; thus stone served to prevent the movement of the sand as the water escaped upward from the sand and also provided a foundation satisfactory for the support of concrete maintained dry until set.

In rock cuts a floor of sand was generally placed as the length of each cut was small.

Where the peat beds were found to extend to depths below the grade chosen for the invert of the aqueduct, the trench was widened and the peat was taken out to whatever depth it would extend; sand and gravel was then placed in the bottom of the trench under water and after having been built to about 2 feet above invert grade, it was under-drained and allowed to settle. This bed of sand was then trimmed in the ordinary way and provided a strong foundation.

In the case of flowing clay foundations it became necessary to open the trench wider than for the standard structure, in some cases to build piled foundations and to use a heavily reinforced invert. Great care was necessary in backfilling in such trenches to prevent the transmission of pressures irregularly to the structure.

HEAVY INVERTS FOR GRAVITY STABILITY

Along Snake Lake, which parallels the aqueduct route for two miles near the Intake, and at certain other points, a porous foundation would have been the source of a serious trouble inasmuch as the surface waters would stand higher than the structure itself and the structure when empty would be liable to float. Generally along such locations the material available for backfill was of a peaty nature and light in weight. Precaution was here taken of building a heavily weighted invert; the engineer's judgment was constantly at test as to whether a weighted invert should be considered necessary or not. With a structure 10 feet 9 inches wide inside, the expense of such an invert was very great and was avoided wherever the earth of the trench floor seemed fairly tight. In deciding upon the use of a weighted invert for this purpose the following options were discarded for the reasons set out:

a. Imported backfill of earth—Too expensive.
b. Increased overfill—doubtful of effectiveness and necessarily huge in quantity.
c. Weighted arch or superstructure—not too efficient and would require a very sturdy invert.

The success of the design chosen, and the efficiency of the supervision had, have been proven through the first year's operation as the aqueduct through these locations is still secure in place although frequently far from full of water, and although it has been constantly wholly submerged.

BACKFILLING

The specifications required that between the walls of the trench and the aqueduct the earth backfill should be tamped carefully to a depth of 4 feet. This precaution was taken in conjunction with a moderately light design of arch, which arch, however, was quite safe against pressures of earth backfill even without packed earth at the haunches. In cuts wholly in muskeg it was impossible to carry out such a specification. In a few cases a slight addition to the thickness of the arch haunches was provided but generally the only precaution taken was the deposition against each haunch of imported sand and gravel to the depth prescribed.

The backfill was then completed with machine, generally the machine used by the contractors for the excavation of the trench. It was piled to a depth of 4 feet upon the crown in the case of solid earth, or of 5 feet in the case of peaty material. The minimum width of backfill top prescribed was 8 feet or where that was exceeded by the clear inside width of the aqueduct, then that greater width became the governing dimension for the top of the backfill. The side slopes of backfill were one and three-fourths horizontal on one vertical, which proved to be satisfactory. The only modification made in these side slopes was along Snake Lake where high waters of the lake would rise upon the face of the slope; here the slopes were made three horizontal on one vertical.

The backfill was grassed over with a selected mixture; very heavy sowing of seed assuring a thick bottom on moist soil and insuring a catch on the driest sections. The seeding operations included the removal and burning of stumps and

*Continued from Page 96.

CHUTING CONCRETE TO INVERT

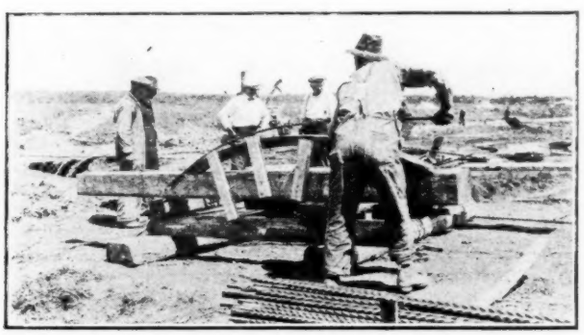
other combustible rubbish, removal of stones, trimming and crowning of the backfill and the raking and rolling of the seed bed. This backfill was thoroughly stirred up with specially designed harrows built to hold themselves on the summit of the dump; no rolling was done but the seed was well buried, a shelter crop of grain being planted at the same time.

CONCRETE MAKING

Throughout the work of aqueduct construction control of the mixture of sand and gravel was maintained by the District's engineers through careful inspection and direction of the operation of the District's own gravel pit where the excavation, screening and re-mixing of the sand and gravel was carried on, producing a uniform concrete aggregate with the desired proportions of sand and of dust. It must be remembered the prime objective in the manufacture of concrete for this conduit was water tightness with economy in the consumption of Portland cement.

This material when dry weighed about 120 to 125 pounds per cubic foot or with 4 per cent moisture, a common condition, 110 to 112 pounds per cubic foot. About 29 cubic feet of aggregate was sufficient to build one cubic yard of concrete in place, allowing for all waste both of aggregate and of concrete.

The average consumption of Portland cement was 1¼ barrels per cubic yard for all work in the 100,000,000 gallon section of the water supply scheme—the easterly 85 miles. The consumption of Portland cement in the pressure pipe of the Red River Valley Siphon was about 2 barrels per cubic yard in a mixture averaging about 1 bag of cement, 1½ cubic feet of sand and 2½ cubic feet of gravel not over 1¼ inch in diameter.



BENDING STEEL FOR INVERTS

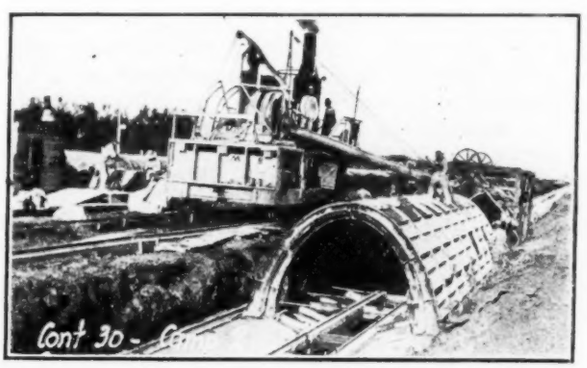
POURING ARCH FROM CONCRETE TOWER
INVERT CONSTRUCTION

Generally speaking the invert of the aqueduct was laid in pads of 15 foot lengths, alternate pads being first laid and when these were hardened the closures being placed. The process of invert making included the placing, tamping and screeding and the floating and trowelling of the surface exposed to water flow. The shoulder was built to a level plane at the chosen elevation, its inner margin being about one inch within the wall of the arch at the foot thereof. This practice afforded a clean and definite line of intersection between the inner surfaces of the arch and the invert. Into the green concrete of the shoulder a thin wooden strip was placed and bound by the setting concrete. After the concrete had been set and before it became hard this shoulder was brushed with wire brushes removing all laitance and exposing the pebbles of the concrete.

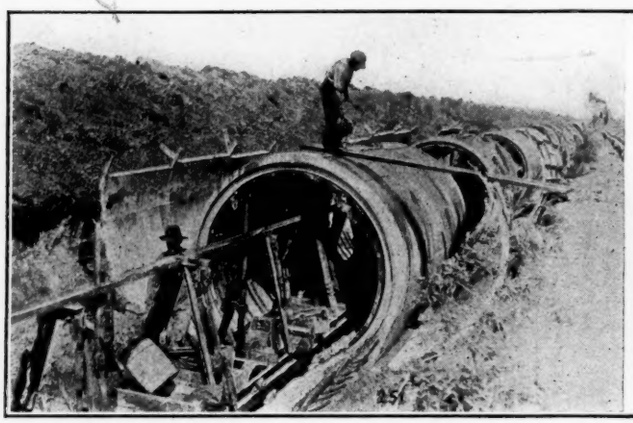
ARCH CONSTRUCTION

The arch was commonly built within 45-foot forms, each set of forms being arranged for transport up and down the trench upon a suitable carriage. The bulkheads were designed to support and to secure the crimped copper strip water stop. As the trench was commonly in shallow cut it was necessary to mix the concrete with some slight excess of water, although the pressence of the fine sand in the aggregate gave a considerable fluidity to the mixture.

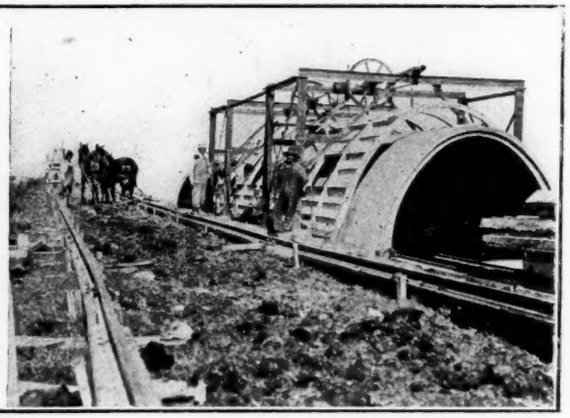
It was, therefore, necessary to carefully work the concrete into place in the form and, after filling the form, to keep adding concrete, at the same time working the material off the surface



POURING ARCH FROM TRAVELING MIXER



REMOVING FORMS AND SPRINKLING ARCH



REMOVING OUTSIDE FORMS

of the crown of the inner form until the material became too stiff for further working. After the first season of construction it was found that this precaution ensured the building of an arch structure without longitudinal crown cracks, a common distressing difficulty in all arch building, especially where the crown is thin and the arch form flat or of large radius.

RED RIVER CROSSING

* * * The easterly four miles of the Red River Valley siphon is a 96-inch diameter by 8-inch wall reinforced concrete pipe, trench built in 15-foot sections and in the standard two portions namely, invert first and superstructure following. The transverse joints were ultimately caulked with a V of neat cement hammered into place. The backfill over this 96-inch pipe and over the other circular pressure pipe at easterly river crossings is 6 feet in depth, it being more important to prevent frost forming within the pressure pipe whose perimeter is entirely wetted, than within the horseshoe section whose crown is never wetted.

Between the Red River Margin and the site chosen for the Water District's Reservoir at Mile 11 the conduit is a 66-inch diameter by 81inch wall Lock Joint reinforced concrete pipe, manufactured at a central point and in 8-foot lengths, transported to the trench on railway cars and laid and jointed in the trench, the jointing not being done until the pipe had been covered to a depth of 1 foot with earth and had obtained a uniform temperature.

TRENCH WORK

This trench was very interesting. The contract provided for vertical payment lines and the contractors decided that for convenience in operations those payment lines must also be the construction lines. The first operation was to drive twenty foot round wooden piles along each side of the trench and at intervals of 2½ to 4 feet. These piles afforded support for the steam shovel with which the earth was removed from the trench and also insured that the berm of the trench should be firm and capable of supporting the machine with which the heavy pipes were lowered into the trench. The entire process of excavating, pipe laying and preliminary backfilling was confined within a distance of less than 500 feet as a rule. Backfilling to a depth of 1 foot above the pipe followed immediately after the laying of the pipe to line and grade and the building of supporting haunches of plain concrete alongside the pipe. The trench wall piling was then withdrawn and the piles were carried forward for second use.

This Red River Valley siphon passes through a soil bed whose sea-deposited clay is heavily impregnated with sulphates of sodium, of magnesium and calcium and bearing occasionally some other salts. To prevent reaction of these salts in ground waters upon the reinforced concrete pipe, this trench, from Mile 13 to the Red River, and its extension through the city of Winnipeg from the Red River to the city reservoir, was thoroughly underdrained.

An 8-inch vitrified tile was laid with open joints along the lower corner of the trench, and, after the shoulders or haunches of the concrete had been built alongside the pipe in place, a backfilling of coarse gravel was placed nearly to the top of the shoulders and insured the collection of water seeping from the trench walls and its delivery to the drain tile.

Similar methods of construction were applied to the 48-inch diameter by 6½-inch wall reinforced concrete Lock Joint pipe line laid from the west shaft of the Red River tunnel to the City of Winnipeg reservoir on Logan avenue, a distance of 2.3 miles.

To be concluded

Great Lakes-St. Lawrence Waterway

After discussion by a largely attended and enthusiastic congress to consider the subject of a waterway connecting the Atlantic with the Great Lakes, the congress on July 25 adopted a resolution urging the United States Congress to act quickly with a view to the construction of such water-way. A telegram was received from Herbert Hoover urging that the construction of the proposed water-way be under the direction of a single public works department organized to replace the various bureaus and departments doing Federal work, which latter feature has already been urged upon congress by numerous organizations.

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The Federated American Engineering Societies

There was held in Washington, D. C., on June 3rd and 4th, a conference of representatives of 71 engineering and allied technical societies, the purpose of which was to organize a federation of such societies "to further the public welfare wherever technical knowledge and engineering experience are involved and to consider and act upon matters of common concern in the engineering and allied technical professions."

The conference adopted a constitution and by-laws providing for "The Federated American Engineering Societies," to which any national, district, state or local society or organization of the engineering or allied technical professions may be admitted by vote of the American Engineering Council. The members of this council, in which is vested the management of the organization, consist of representatives of the member societies, one for each thousand members or major fraction thereof. Each national society shall pay to the F. A. E. S. as dues $1.50 per year for each of its members, and each district or local society $1.00 per member. The expressed aim and purpose of the society is that given in the quotation above.

All societies qualifying for membership are invited to become charter members of the F. A. E. S., and appoint delegates to the first meeting of the American Engineering Council, to be held in the fall of this year, the exact date of which has not yet been decided. Meantime the organization is being represented by the "Joint Conference Committee" of the "big four"—the A. S. C. E., the A. I. M. E., the A. S. M. E., and the A. I. E. E.

Probably the first question that will occur to societies when considering membership in the federation will be that of the dues. The American Water Works Association has over five thousand members, its dues were $5 a year, but it was found necessary to raise these to meet expenses, and this will be voted on next year. The American Society for Municipal Improvements has about 600 members. Its dues are $5, and last year its expenditures exceeded its income by about $475.

The New England Water Works Association has about 900 members. Its dues are $4. The Louisiana Engineering Society has about 275 members, the dues are, we believe, $10, but the expenditures in 1919 exceeded the receipts by about $400.

These societies are the only ones of which the figures are convenient to our hand, and are probably typical. All undoubtedly hope that their expenditures will fall (they are largely for printing, and we see no signs yet of any decrease in them), but meantime we question whether, in view of a deficit last year, the A. W. W. A., will feel justified in adding $7,500 to its expenditures, the A. S. M. I., $900, the N. E. W. W. A., $900 and the L. E. S., $275. In each case this would probably necessitate raising the dues by the $1.50 or $1.00 required for membership in the federation, and this in turn would require a constitutional amendment at the next annual meeting. It does not, therefore, seem probable that many organizations can join the federated societies until after their members have voted to increase the dues for this purpose, except such (if there be any) as have already so voted.

The four leading societies have a combined membership of about 35,000, which will give an income of about $52,500. If most of the eligible societies should join, the income would probably exceed $150,000. This would be sufficient for carrying out quite ambitious projects. The question suggests itself, however, whether it would not be better to begin on a smaller scale, with dues that would not at the outset frighten off the scores of smaller societies which are just now struggling to meet their present expenses.

Specifications for Converting Macadam To Sheet Asphalt Roadway

The highway program of Burlington county, N. J., provides for the conversion, during the years 1919-20-21, of 60 miles of water-bound and oil-treated macadam to wider sheet asphalt pavement on the original foundation. About 40 miles will have been completed by the end of the present season at a cost that has increased from about $1,000 per mile last year, to $1,500 per mile this year. All of the work is done by contract as described on page 133 of PUBLIC WORKS, August 7, and the asphalt for the binder and top courses was mixed at the contractors central plant described on page 146 of this issue of PUBLIC WORKS.

The construction, reconstruction, maintenance and all other road work in Burlington county has been designed and is executed under the supervision of James Logan, county engineer, under a standard form of specifications, bids, contracts, bond, and other necessary documents which, being bound together and endorsed with the file number and contract number, provide a complete record of the work and give unusually concise and comprehensive data for official purposes and for the use of the engineers, inspectors and contractor, who find there all essential information properly arranged and the sequence and details of different operations clearly presented.

The front cover gives the route, location and name of the road, the chapter and section of law

under which the contract was awarded and the contract and specifications were submitted and approved. The specifications are preceded by a description of the road and its history, and are divided into three parts, covering the widening and resurfacing, the surface, and the details.

The usual definitions and general clauses relative to rights, duties, and requirements, are supplemented by specific descriptions of the methods and requirements provided for widening the road, scarifying, crowning and rolling, broken stone course, binder course, shoulders, watering and rolling the old macadam in the preparation of the foundation for the sheet asphalt. These are followed by a general description of the sheet asphalt surface with paragraphs specifying the materials, methods of testing composition of refined asphalt and asphalt cement, fluxes, and their physical properties and those of the binder stone, sand and filler; these being practically the standard specifications of the American Society for Municipal Improvements.

The specifications are followed by a proposal blank ready for the items to be filled in, and signed by the bidder; by certificates approving the designs, specifications, proposal and contract, which are signed by the engineer and solicitor; by a certificate of approval of materials, drawings and calculations signed by the division highway engineer; and by an approval of the specification and order to advertise which is signed by the clerk, by the assistant state highway engineer, and the chairman of the state highway commission.

There is an affidavit as to publication and notice signed by the clerk and notary; a report on bids received, signed by the presiding officer and clerk; a report on bids opened, signed by the solicitor and engineer; an approval of equipment signed by the engineer; and a tabulated summary of bids giving the percentage of the engineer's estimate of cost for each bidder on the different items of quanities and price.

There is a certificate of the award of contract signed by the clerk, and the contract itself signed by the chief clerk and the bidder and witnesses.

There is also a form for the surety corporation bond, approved and signed by the director of the surety company and by the finance committee. There is a certification as to funds applicable to the contract signed by the bookkeeper, recommendations for approval signed by the state highway engineer, and the approval form signed by the chairman of the state highway commission.

Standby Power Plants

Power plants using hydraulic power where a considerable percentage of the ordinary capacity of the stream is utilized find it necessary to provide standby plants. These have sometimes been for operation by steam, and sometimes by internal combustion engines—gasoline or oil. Not so common is it for those using steam to provide an alternative power.

But with the possibility of a coal shortage ahead and recurring annually, it would seem to be the duty of those furnishing power for water, light, transportation, or other public utilities, to consider whether they should not provide themselves with a standby equipment using neither coal nor waterpower; and others to whom a shutdown would involve great loss might well find this to their advantage also. An electric equipment depending upon either of these as its source of power would not, of course, serve the purpose; and gasoline or oil, or natural gas where this is available, would seem to be the only sources of power that would meet the conditions.

Heretofore that coal could not be had in any quantities desired and with delay of a few days at the most, was almost unthinkable, and a duplicate coal-burning plant was a satisfactory safeguard against interruption of service. But with coal mining and transportation conditions in so unsatisfactory and unsettled a state, the above suggestion is forced on our attention.

La Grande's Water Supply

A few weeks ago a report was submitted to the City Council of La Grande, Ore., by Louis C. Kelsey, as consulting engineer, relative to an improved water supply.

Three propositions were reported on, one providing for a 22-inch pipe line, 44.8 miles long and costing $1,865,220; the second an 18-inch wood-stave pipe line, costing $879,473, or an alternate line following the same route but using a 20-inch wood-stave part of the way and a 16-inch vitrified pipe the remainder of the way and costing $831,486. The two latter propositions contemplate a dam which would cost about $150,000. The third plan contemplates replacing an existing pipe line with one consisting of 12-inch and 14-inch steel pipe and 18-inch wood pipe, and the construction of a new dam.

The estimates are based on an assumed consumption of 6,000,000 gallons a day, or 300 gallons per capita for a population of 20,000.

The second of the two plans is the one recommended by Mr. Kelsey.

Seattle Water Supply Delayed

The construction of the proposed $3,000,000 68-inch steel pipe line forming part of the improved water supply for the city of Seattle, Washington, has been delayed by the failure to authorize the expenditure of $3,600,000, the amount of the lowest bid for the construction of the eighteen mile line. It is believed that by waiting until next winter a saving of $350,000 can be accomplished in the cost of the steel, and that the bond market may also be improved at that time.

St. Louis Building Sewer By Force Account

Because the appropriation was not quite large enough to cover the lowest bid for 4,500 linear feet of the 12-foot and 3,000 feet of the 6 to 8-foot South Harlem sewer in St. Louis, which the contractor offered to do for $382,000, a sum that was considered well balanced and reasonable, the city is organizing a special section under the division of sewers and paving, and will do the work by force account under charge of W. W. Burden, engineer of construction, and W. W. Horner, chief engineer.

Hannibal Municipal Water and Light

No part of the general taxes of the city of Hannibal, Mo., has been used for the support of the electric light plant of that city or for the payment of bonds or interest since the management of the plant was placed in the hands of the Board of Public Works in 1903; and the same is true of the water works plant, acquired in 1913. On the other hand, the plants have furnished without charge street and white way lighting and fire hydrants, which are estimated to be worth, for the year ending May 31, 1920, $4,936 for lighting and $7,750 for fire protection. Also, the plant paid a franchise tax of $4,743, and $907 donated to other municipal departments. Also there was paid from the operating expenses last year $5,421 for extensions and betterments of the water works.

During the year the electric light and power department received from all sources $139,401 and its total expenses for all purposes were $114,263, in addition to $9,350 used for the purchase of Liberty Loan Bonds. Coal expenses for the year for this department amounted to $51,587.

The water department received during the year $61,925, and the total operating expense, including new construction and interest, was $56,185, of which $9,494 was for coal. The water works was purchased from a private company in 1913 for $301,347, bonds being issued for $360,000 to cover purchase price and improvements; and since then $185,000 of the bonds have been paid and cancelled and in addition there has been spent $120,270 for extensions and betterments.

Although production costs have greatly increased during the past few years, there has been no increase in rates for electric light or power or water servvice. For electric lighting the base rate is eight cents per k. w. h., with a 10% discount for a monthly bill of between one dollar and five dollars, 20% for between five dollars and ten dollars and a six cent rate for all over ten dollars. For water service the rates gradually decrease from thirty cents per thousand gallons for 15,000 gallons a month or less, down to eleven cents for all over 600,000 gallons a month; these rates being subject to 10% discount on bills paid before the 15th of the month. There is a minimum net monthly charge of 75 cents for each water meter.

Convincing Council of Desirability of Meters

The water commissioners of Erie, Pa., have been urging the city council of that city to permit them to install meters generally, but without success. Recently they have endeavored to demonstrate some of the advantages which they claim for meters by installing meters in the homes of the councilmen. About the first of July four of the councilmen permitted meters to be installed in their houses and agreed to read the meters and figure for themselves how the cost of water service under the proposed meter rate would compare with the flat rate now being charged. One of the councilmen is reported to have said that he calculates that he would have effected a saving of at least five dollars a year in the past had he been paying by meter rather than flat rate. The water commissioners believe that the experiment will prove to these councilmen their assertions concerning the advantage to citizens of the use of meters, and hope that the council will then reconsider their former action and permit the general installation of meters throughout the city.

Fire Fighting Efficiency of St. Louis Water Supply

The water works system is found by the National Board of Fire Underwriters to be in very good condition from a fire fighting point of view, only a few minor extensions being recommended.

The National Board of Fire Underwriters has a reputation of being difficult to please when it comes to obtaining its approval of the sufficiency of water supplies as agents for fighting fire. It may, therefore, be considered as high praise that it has practically nothing but approval to offer concerning the water works system of So. Louis, Mo. During the first two months of this year engineers of the board made a thorough investigation of the water works of the city and in a report published in July give a very complete description of the entire system as it was at that time.

A previous inspection had been made in 1912 and since then a number of important improvements had been made, the chief of these being a new intake with ports at a lower elvation than those in the old intake, and an 8-foot tunnel extending to the Chain of Rocks pumping station; a 1000,000,000 gallon low-lift centrifugal pump in this station; a filtration plant with a nominal capacity of 160,000,000 gallons a day; a reinforced concrete conduit 6.5 by 5.96 feet between Baden and Bissell's Point; new pumping plant for the Bissell's Point pumping station; enlarging the Competon Hill reservoir; adding 97 miles of pipe to the distribution system, and installing about 5,400 modern type hydrants.

Summing up the results of the investigation, the engineers arrive at the following conclusions:

Organization. The officials of the water division are well qualified for their duties and the number of employes is ample.

Records. Plans and records are complete.

Emergency Operations. Fire alarms are received in three water works quarters and emergency operations are good.

Source of Supply. An inexhaustible supply is available from the Mississippi river.

Intakes. Two substantial masonry intake towers, one located at the deepest point of the channel, with adequate inlet ports well below low water. The probability of interruption of supply from floating ice or shifting of channel is slight. Tunnels to low-lift pumping station are of ample capacity. Good facilities are provided for handling slush ice in the wet well.

Pumping stations. Pumping capacity at the low-lift station is ample and at the high-lift stations is satisfactory for present needs in view of the numerous large emergency connections between the High and Low services; excellent records of closed gates and good emergency provisions; the 40,000,000-gallon pump, capable of operating on either service, proposed by the water division, will add to the reliability. Boiler capacity is adequate and all equipment is in good condition except some of the old boilers, which are usuable. Steam piping is well laid out and installed, but additional valves would be of advantage at the low-lift station. At least thirty days' supply of coal always on hand. Suction and discharge piping generally well arranged. The stations, although of substantial construction, in good condition, and with well guarded hazards, are not of fireproof construction, the various sections are not cut off by fire doors and the different buildings of the plants are mutually exposing. The inadequate private fire protection in all and distance of the low-lift pumping station from the nearest fire station may lead to serious interruption from fire.

Filtration Plant and Storage Reservoirs. The total available content of the various basins and chambers at the filtration plant and the storage reservoirs at Baden and Bissell's Point is 286,000,000 gallons, or nearly twice the maximum daily consumption. Filters, with suitable allowance made for units out of service for cleaning, are of adequate capacity for present needs. The various units of the filtration plant and the storage reservoirs are well arranged and can be by-passed through many emergency connections.

Main Supply Conduits. Main supply conduits are now in duplicate from Chain of Rocks to Bissell's Point; the probability of interruption of supply from the failure of a conduit is slight.

Distributing Reservoir. Advantageously located, well constructed and at an elevation to give good pressures in the congested value district; contains one day's average consumption on Low service and ten hours' fire flow.

Consumption. Consumption is moderately high and is steadily increasing; it can be materially reduced by the general installation of meters, as has been frequently demonstrated under similar conditions in other cities. Such reduction in the consumption would defer for years the heavy expenditures involved in obtaining a new source of supply, which the present rate of consumption will soon make necessary, as well as increase fire protection in all parts of the city.

Pressures. Pressures are well maintained at the pumping stations and in the congested value district. During periods of extreme consumption, pressures in the High service and in the southern part of the Low service are greatly reduced and in a few places are too low to furnish good fire engine supply.

Protection. Reasonable protection for the congested value district requires a fire flow, in excess of maximum domestic consumption, of 12,000 gallons a minute, with a distribution system capable of delivering this amount about any block, and with hydrants so located as to deliver two-thirds of this quantity upon any large fire through hose lines, none exceeding 600 feet in length; in addition the arterial system should be capable of delivering 8,000 gallons a minute for a second fire. The total quantity includes an allowance for loss from broken service connections and hydrants left open incidental to a large fire. In manufacturing and minor mercantile districts, 5,000 to 10,000 gallons are necessary. Closely built residential sections of 3-story and higher buildings require 3,000 to 5,000 gallons, and in outlying residential districts a minimum of 1,500 gallons is needed. Fire flow tests showed that these quantities are generally available under ordinary consumption conditions, but that increased consumption in extremely warm or cold weather would leave insufficient quantities in some parts of the south end of the city, in the high portions of the High service area, and where the gridiron consists of long lines of 6-inch mains.

Mains. Main arteries and secondary feeders form a system which is generally well arranged, well looped and of adequate strength; High service arteries are very long and show a high friction loss at times of extreme consumption. Minor distributers are fairly well gridironed in the closely built parts of both services, but in a number of localities of recent development there are many 6-inch mains of excessive length between cross-connections; dead ends are not particularly numerous. The oldest mains are badly incrusted. Several important mains have recently been damaged by electrolysis.

Gate Valves. The system is fairly well equipped with gate valves in all parts of the city. Valves are systematically inspected and maintained in very good condition.

Hydrants. Spacing in the congested value district is excellent and in other sections fair to good. Hydrants recently installed are of a good type but over a sixth of the total number are of the obsolete underground type; only a small proportion have gated connection to main; hydrants are in good condition but considerable trouble is caused by promiscuous use by those not connected with the fire department or water division.

The streets of Twin Falls, Idaho, are occupied by the mains of Elm Park Water Company, and an injunction has recently been issued restraining the city from interfering with the mains of the company; except that the city is authorized to make such changes as may be required by construction work in streets and avenues, but is required to replace the mains without damage to the system. The city proposes to fight in court the company's claim to rights in the city streets.

A Constitution of Industrial Relations

Principles of Industrial Employment Relations, including Open Shop, Right of Association, Production, Wages and Management, Hours of Labor, Government, and Public Service Employment as recommended by the Committee on Labor of the Associated General Contractors' of America.

To promote the establishment of fair and satisfactory practical relations between the employers and employes, study and investigation has been made for the Associated General Contractors' of America by their special committee on labor, Leonard C. Wason, chairman and H. J. Bernnan, Tylor Field, G. O. Muhlfeld, F. W. Smith, and C. P. Waterman, officials of important construction interests in different parts of the country.

Their conclusion is that in the struggle to interpret and to establish relations between employers and employes, there is needed a declaration of principles so basic, so wide in scope, so fair in application, so clear in expression, that it may be accepted as a constant measure of the justice and wisdom of the temporary devices that must be framed to meet fluctuating conditions.

Such a declaration the committee has widely, but unsuccessfully, sought. The closest approach to it they have found in the Statement of Principles enunciated by the Chamber of Commerce of the United States, (February 2, 1920) and included in Referendum No. 31 on the report of the committee on Industrial Relations regarding employment relations (June 9, 1920). This statement is as follows:

The interest of the public, which includes every individual in the community, is paramount. It is composed of interdependent interests whose just balance necessitates that impartial justice be accorded to every individual.

There is a mutuality of interest among employers, employes, and investors. Their interests as well as the public interest must be defined and protected and to this end public opinion must be kept informed and enlightened.

The Employment Relation. Every person possesses the right to engage in any lawful business or occupation and to enter, individually or collectively, into any lawful contract of employment either as employer or employe.

The Open Shop. The right of employer and employe to enter into and to determine the conditions of employment relations with each other (without reference to the affiliation or non-affiliation of either with any organization) is an individual right of free contract possessed by each of the parties.

Right of Association. All men possess the equal right to associate voluntarily for the accomplishment of lawful purposes by lawful means. The association of men whether of employers, employes, or others, for collective action or dealing, confers no authority over and must not deny any right of those who do not desire to act or deal with them.

Responsibility of Combinations. The public welfare, the protection of the individual, and sound employment relations equally require all associations or combinations be subject to the authority of the State. As the public interest is paramount, full publicity of facts of industrial relations is necessary.

Obligation to Secure Production. To develop, with due regard for the health, safety and well-being of the individual, the maximum capacity and output required of industry is the common social obligation of all engaged therein.

Wages and Management. The wage of labor must be drawn from the product of industry and must therefore be earned and measured by its contribution to production. All employes are entitled to complete business information in matters affecting the terms of their employment; and frankness is essential. In order that the worker, in his own and the general interest, may develop his full productive capacity, it is the duty of management to assist him to secure regular employment suited to his abilities, to furnish him with incentive and opportunity for self improvement, and to provide proper safeguards for his health and safety.

Hours of Labor. The number of hours in the work day or week in which required maximum output, consistent with the well-being of the workers, can be maintained in a given industry should be ascertained by careful study and never should be exceeded except in case of emergency. One day of rest in seven, or its equivalent should be provided.

Adjustment of Employment Relations. Adequate means satisfactory both to the employer and to his employes, and voluntarily agreed to by them, should be provided for mutual discussion and adjustment of employment relations.

Community of Interest. The greatest measure of reward and well-being for both employer and employe, and the full social value of their service to the public must be sought in the successful conduct and full development of the industrial establishment in which they are associated. Intelligent and practical co-operation based upon a mutual recognition of this community of interest constitutes the true basis of sound industrial relations.

Government Employment. The State is sovereign and cannot tolerate a divided allegiance on the part of its officers and servants. While the right of government employes, national, state or municipal, to be heard and to secure consideration and just treatment should be amply safeguarded, the community welfare demands that no combination shall be permitted to prevent or impair the operation of government or of any governmental function.

Public Service Employment. In public service activities the public interest and well-being must be the paramount and controlling consideration. The power of regulation and protection exercised by the State over the corporation should properly extend to the employes in so far as may be necessary to

assure the adequate, continuous, and unimpaired operation of public utility service.

The Committee on Labor of the Associated General Contractors desire the greatest possible publicity and discussion of the foregoing statement. It invites constructive criticism in order to perfect this draft, if necessary.

It is hoped that it may ultimately be widely adopted as the guide for all industrial employment relations.

Immigration in 1913 and in 1920

During the six months from July 1, 1919, to December 31, 1919, the total number admitted was 162,883 and departed 166,212—a net loss of 3,329. In the same six months of 1913 (the last year of our normal immigration), the total number admitted was 734,869, and departed 153,790—a net gain of 581,079. An analysis of these figures by races indicates that in 1913 there was an increase in 39 of the 40 races listed.

In 1919, however, twelve of the races that normally provide the bulk of our unskilled labor supply including Serbians, Greeks, Italians and Roumanians, show a total decrease of 86,102, and six other races that also usually furnish large numbers of unskilled immigrant workers including Russians, Ruthenians, Bohemians, and Lithuanians, show a total increase of only 2,159.

The eighteen races that during this period show an increase of 64,443 including the English, French, and Scotch, do not generally engage in the basic agricultural or industrial work of the country. The Mexicans also show an increase of nearly 8,000, but they were generally admitted under bond to meet the agricultural needs of border states. It has been stated also that more than half of the total number admitted were women and children coming to join members of their families, while practically all of those who departed were adult male wage earners.

During the first five months of 1920, the preliminary figures for the Port of New York (which usually handles about 80% of the total immigration and emigration for the country) show a net increase of 38,288.

Practically all of those who left the United States during these five months were able-bodied male wage earners. Of those who entered, about half were women and children and a large part of the balance were natives of Italy and returning reservists. Many of the men admitted had previously been in the United States and practically all of them had definite destinations and knew exactly where they wanted to go.

Comparatively few new able-bodied aliens are arriving, as a number of the European countries do not yet permit men of military age to leave their borders. Our own war-time passport regulations requiring an American Consul's vise before an alien is allowed to board a vessel, the enforcement of the illiteracy test and the fact that many of the large passenger steamers formerly bringing in immigrants are now out of commission, will temporarily retard a return to the pre-war immigration to the United States.

Excerpt of data issued by the Inter-Racial Council.

Our Alert Competitors

Press reports state that exceptional inducements are offered in Peru to European immigrants who, under certain conditions, receive free passage to Peru from any part of Europe, are granted six days free board and lodging after arrival, and free conveyance to any part of the country, besides other inducements.

Evidently the government of Peru realizes the necessity of abundant and reliable labor to develop her great natural resources and has set about securing it in a rational way. In the present distressing conditions throughout Europe, this cannot fail to be alluring to thousands of sturdy peasants who would probably be much more desirous of coming to the United States and would respond to smaller inducements here.

In some countries the war losses are more than counterbalanced by the lack of supplies and capital, and the peasants are and will be encouraged to emigrate. This is probably true in large parts of Germany, Hungary, Bulgaria and perhaps other countries whose undesirables we may well wish on the most remote countries, while there will be an abundance of other and more desirable immigrants knocking at our doors if we only open to them.

Decreasing Efficiency of Labor

From records made of cargo handling at New Orleans on three ships of the Morgan Line, it is shown that in fifteen unloadings in 1914, 7,672 tons of cargo were handled by 20,218 man-hours, about 2.6 man-hours per ton.

Fifteen unloadings of the same ships in 1919-20 with practically the same cargoes and the same workmen showed 7,748 tons handled by 28,638 man-hours, about 3.7 man-hours per ton, showing an increase of 41 per cent of labor and 1 per cent additional tonnage. The number of pounds handled per man-hour has decreased from 793 in 1914 to 547 at the present time showing a loss of 45 per cent efficiency.

In connection with this record it is interesting to note that in 1914 thirty-four claims aggregating $100 were paid for materials stolen from cargoes handled, while in 1920, under the same conditions, there were paid six hundred and fifty-five claims aggregating more than $20,000 for pilfering from the cargoes handled.

Labor Turnover

The monthly labor review of the U. S. Bureau of Labor statistics states that the records of 1908-19 show that work equivalent to the full time (3,000 hours) of one year's labor for 2,117,682 workers involved 5,045,317 labor changes equivalent to considerably more than a complete annual turnover of the working force.

After a month's strike the Brick Contractors Association and Brick Layers Union of Pittsburgh have signed an agreement giving a wage of $1.50 per hour.

Recent Legal Decisions

ROAD CONSTRUCTION CONTRACTORS HELD ENTITLED TO FILE SECOND BOND AFTER BID ACCEPTED

In an action on the bond of a surety company securing a road construction contract, at the instance of a materialman who furnished materials and labor to the contractor, the defense was that before executing the surety bond the contractor had given a bond with personal security, and that the surety bond was unnecessary under the law and void. This case is illustrative of a practice which it seems is becoming common in Indiana —the practice of bidders on public works, for the purpose of saving the premium on the bond in case they should not be the successful bidder, of filing a bond with personal surety and then, if the work for which they bid should be awarded to them, of giving a surety company bond to cover the proposed work, with the idea that such bond, when approved by the board shall in all things take the place of the personal bond filed with their bid.

If it were conceded that there was no legal necessity for the filing of the surety bond, and that the board of commissioners had no right or authority to approve it, the Indiana Appellate Court, Massachussets, Bonding & Ins. Co. v. State, 127 N. E. 223, thinks that it does not necessarily follow that the surety bond is without legal force and effect. If the contractors, after the contract had been awarded to them, for any reason desired to procure a new bond, and thereby relieve their former bondsmen from any liability to answer for their failure to pay for labor and materials furnished to them on account of the construction contract, there is no statute or rule of law preventing such action, or which would render such bond so taken void. In such case, as between the contractors and such new surety, or between such surety and the labor or materialmen, the bond being otherwise sufficient, any action by the board of county commissioners approving said bond would be entirely unnecessary, and as between the parties above named, would in no way change the legal effect of the bond.

It is also held that a surety company cannot avoid liability on such a bond because the contractors failed to pay the premium, nor can the contract be revoked on that account. Judgment for plaintiff was affirmed.

MECHANICS' LIENS—WORK AND MATERIALS FOR PUBLIC LIBRARY

New York Lien Law does not permit the enforcement of a mechanic's lien against the land and building of a municipal corporation. It does permit the enforcement of such a lien against moneys of the corporation applicable to the construction of the improvement. When labor and materials furnished have gone into the construction of an improvement the question may arise whether there are any such moneys to which a lien can attach. Labor and materials were furnished to the builder of a Carnegie Library for a city under contract with a committee appointed by the philanthropist on a site furnished by the city. The New York Court of appeals holds, Bexauer & Lemke v. Luke O. Burke & Sons Co., 127 N. E. 329, reversing 182 app. Div. 924, that the parties furnishing the labor and materials were not entitled to a lien on the balance of the philanthroptist's funds in the hands of the committee, but due the builder, on any theory that in substance moneys owing by the committee were owing by the city. The lien failed for lack of any subject-matter to which it could attach. There was no lien on the building by force of consent to the improvement, for that was a public one on the land of a municipal corporation. There was none on the corporate moneys, for no corporate moneys were applicable to the contract. There was none on the moneys due from the committee to the builder, from one contractor to another for none is given by the statute. Though the building contract gave the committee the privilege of withholding payments from the builder until liens had been discharged, that privilege could not create a lien if none would otherwise exist.

WAIVER BY COUNTY OF NECESSITY FOR CONTRACT BOND

Where a contractor for repairs on a county courthouse did not furnish the bond required by the contract, and there is no requirement that such a bond should be given aside from the contract itself, it is held, Obelisk Waterproof Co. v. Cloher, 11 Misc. (N. Y.) 182 N. Y. Supp. 303, that the board of supervisors, by accepting the bond which was executed, and permitting the contractor to proceed with the work, waived the giving of any other security.

STOP NOTICE STATUTE NOT APPLICABLE TO WORK ON PUBLIC HIGHWAY

The California Supreme Court holds, Slayden v. O'Dea, 189 Pac. 1066, that neither section 1183 nor section 1184 of the California Code of Civil Procedure, providing that, in cases of property which is not subject to lien, the owner shall hold sufficient money to pay the claims of persons serving notice, applies to work on a public street or highway, and that the remedy of materialmen in case of a contract let by the public authorities for street work is upon the personal responsibility of the contractor and his sureties, and in the case of a private contract upon a public highway under section 1191, Code of Civil Procedure. A large part of the work upon public highways in California is done under the Vrooman Act and its amendments. The Supreme Court has recently held that in such cases the stop notice feature of section 1183 did not apply. Adamson v. Paonessa, 179 Pac. 880. That decision was based upon the fact that there was no indebtedness from the owner to the contractor to which the statute could apply.

NEWS OF THE SOCIETIES

Sept. 1-3—MICHIGAN STATE GOOD ROADS ASSOCIATION. Annual meeting, Lansing, Mich. President, P. T. Colgrove, Hastings, Mich.

Sept. 7-10—NEW ENGLAND WATER WORKS ASSOCIATION, Annual convention, Holyoke, Mass. Secretary, Frank J. Gifford, 715 Tremont Temple, Boston, Mass.

Sept. 13-17 — AMERICAN PUBLIC HEALTH ASSOCIATION. Annual convention San Francisco, Cal.

Sept. 20-23 — SOUTHWESTERN WATER WORKS ASSOCIATION, Annual convention, St. Charles Hotel, New Orleans, La. Secretary, E. L. Fulkerson, Waco, Texas.

Oct. 12-14—AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Annual convention. St. Louis, Mo. Secretary, Charles Carroll Brown, 401 Lincoin Avenue, Valparaiso, Ind.

Oct. 19-22—INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. 25th annual convention, New Orleans, La. Secretary, C. R. George, Houston, Texas.

Jan. 25-27, 1921—THE AMERICAN WOOD PRESERVERS ASSOCIATION. Annual convention. Place to be announced.

CONNECTICUT ASSOCIATION OF CIVIL ENGINEERS

The annual summer outing of the Connecticut Society of Civil Engineers was held at New London, Connecticut, August 11. The program included a steamboat trip to the Groton Iron Works where the society witnessed the launching of the 9,400-ton steam freighter Hopatcong and were entertained at luncheon.

Afterwards the society and their guests, Gen. W. Goethals and Capt. Frank T. Cable, master of the Holland, the first successful submarine, and builder of the submarine Fulton, visted the U. S. Submarine Base where they were received by Commandant Capt. Oliver, U. S. N. At the base the visitors witnessed a baseball game by their own nine and that of the officers of the base. An inspection of the new railroad draw bridge over the Thames river and the state highway bridge converted day's outing.

CHAMBER OF COMMERCE OF THE UNITED STATES

The result of the referendum vote of the Chamber of Commerce of the United States on the twelve principles of industrial relations embraced in the questionnaire recently issued has been their approval. It has also approved the prohibition of strike by public utility employees and favors legislation providing tribunals with power to enforce adjudication on differences between public utility corporations and their employees.

These recommendations upheld open shop, universal right to engage in any lawful business or occupation, collective bargaining, and the paramount consideration of public interests.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS

The 25th annual convention of the International Association of Municipal Electricians, will be held at New Orleans, La., Secretary, C. R. George, Houston, Texas. The date will be announced later.

LITTLE ROCK ENGINEERS CLUB

At a meeting held July 24 the Little Rock, Arkansas, Engineers Club voted to petition the next legislature to pass a bill appointing an examining board and requiring that engineers should be examined and licensed.

FEDERAL POWER COMMISSION

The federal power commission has divided the United States into five adminstrative districts with headquarters in Washington, St. Paul, St. Louis, Denver and San Francisco.

The work of the commission will be classified as engineering accounting, statistical, regulatory, licensing, legal and operation.

PROBLEMS THAT CITIES ARE STUDYING WITH EXPERTS

Minneapolis, St. Paul, and the University of Minnesota are endeavoring to secure priority of license to utilize the power generated at the federal high dam in the Mississippi River between St. Paul and Minneapolis. Mayor L. C. Hodgson of St. Paul, Major J. E. Meyers of Minneapolis and Fred B. Snyder, president of the Board of Regents of the University of Minnesota form the Board of Municipal Electric Corporation which will present the plea as soon as the Federal Power Commission is organized.

If the license is granted, the municipal electric corporation will install a POWER PLANT at the dam, an electric distribution system to develop and dispose of from 15,000 to 20,000 horsepower, sufficient to supply all the needs of the state university besides affording power for municipal works in St. Paul and Minneapolis.

PERSONALS

Cadwalader, W. S. superintendent of streets, Trenton, N. J. died July 17.

Piper, R. B. city engineer of Medicine Hat, Alta., died July 19th.

Leland, O. M., has been appointed dean of the College of Engineering and Architecture and the School of Chemistry of the University of Minnesota.

Joyner, F. H., has resigned as county road commissioner of Los Angeles, Calif. to accept the position as consulting engineer for corporations in Los Angeles.

Jones, G. W., has been appointed road commissioner of Los Angeles County, Calif.

Neeson, J. H., has been made acting head of the Philadelphia Bureau of Highways.

Johnston, J. H., has been appointed superintendent of highways, Providence, R. I.

Mackall, J. N., has been appointed chairman and chief engineer of the state road commission, Maryland.

Costello, J. W.., has been appointed head of the division of streets, Newark, N. J., in charge of repaving and maintenance of streets, street regulation, and street cleaning and refuse collection.

Hines, Brig. Gen. Frank T., has been appointed chief engineer of the recently created inland and coastwise water way service of the U. S. War Dept.

Heman, August, mayor of University City, Mo., and president of the Heman Construction Company, St. Louis, Mo., died July 15.

Terrill, E. J., has been appointed resident engineer, Federal Aid Road Project No. 37, Independence, Kansas.

Glaeser, Frederick, has been appointed landscape engineer and superintendent of parks, Trenton, N. J.

Ford, Geo. B., has been appointed director of the city planning department of the Technical Advisory Corporation, New York City.

Barthlomew, Harland, has been appointed consulting engineer for drafting a zone law for Washington, D. C.

Ford, George B., has been appointed director of the City Planning Department of the Technical Advisory Corporation, 132 Nassau St., New York. Also, he has recently been retained as advisor on foreign housing to the U. S. Senate Committee on Reconstructino and Production. Mr. Ford has recently completed a long engagement in France where he was city planning consultant to many of the cities of the devastated areas, including Rheims, Arras and Soissons.

Preble, S. E., has been elected vice president and general manager of the Industrial Planning Corporation, Buffalo, N. Y.

Forbes, Hyde, has opened an engineering office in Los Angeles.

Fredenhagen, B. B., has been appointed resident engineer, Federal Aid Road Projects 44 and 45, Salina, Kansas.

Wenger, E. C., has been appointed resident engineer, Federal Aid Road Project 22, Garden City, Kansas.

Schwab, J. E., has been appointed city engineer of Alton, Ill.

Verharen, A. W., has been appointed city engineer of Helena, Mont.

Ferguson, H. F., has been appointed chief sanitary engineer of the Illinois Department of Public Health.

Garrett, Geo., has been appointed city manager of LaGrange, Ore.

Focht, John A., has been appointed engineer of Rockwall County, Texas.

Montgomery, Julian, has been appointed city engineer of Wichita Falls, Texas.

Clark, W. H., has been appointed consulting engineer to the highway department of the state of New Jersey.

New Appliances

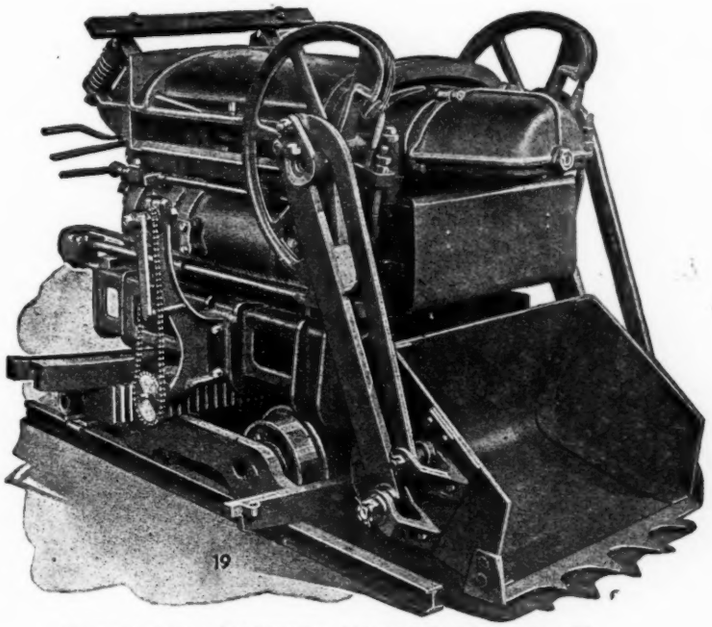
Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations

THE SHUVELODER

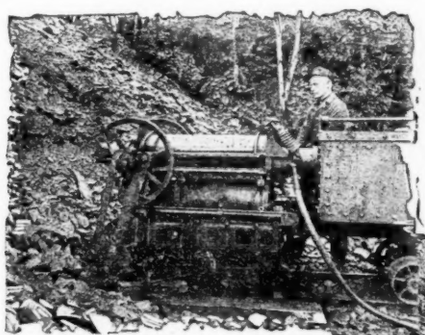
The accompanying engravings illustrate the description of the Shuveloder published in PUBLIC WORKS, on August 7, Page 141.

This machine, manufactured by the Lake Superior Loader Co., especially for loading muck and spoil in tunnels and in narrow trenches, can be operated in a transverse clearance of 5 feet and a vertical clearance of 7 feet; it commands a transverse width of 11 feet and can load at a heighth of 50 inches above top of rail. The bucket which, in the large engraving, is shown in the lowest position, previous to commencing the cycle of operations, is actuated directly by four pneumatic cylinders operating with a pair of slotted links and a rope-driven revolving mechanism that impart to the bucket a thrusting, lifting, and revolving motion with a reciprocating action and return movement closely simulating the operations of hand shoveling.

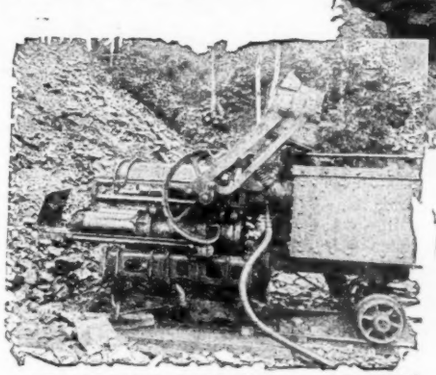
The operating views show the machine in position in a tunnel drift at each point in its cycle of operations.



SHUVELODER MOUNTED ON PORTABLE TRACK



Special provision is made to avoid heavy stresses or injury to the machine when the bucket encounters unusually great resistance. The machine has a rated capacity of 45 tons per hour when operated by air under 80 pounds pressure, and requires only one man to handle it except when it is moved by hand on the narrow-gauge track, an operation which is easily effected, corresponding to the movement of a 2-ton dump car, and avoiding the expense and complication of locomotive gear.



SHUVELODER OPERATING IN TUNNEL

BARRETT PAVING PITCH

A small pamphlet just issued by the Barrett Company describes the use and advantages of cold tar pitch for water-pitch joints and fillers in brick, stone block, and wood block pavements. No. 1 is unaffected by water, alkalis, street acids, oil and gasoline, or any other matters commonly found in streets and roads.

It is strongly adhesive and cohesive and has sufficient elasticity and plasticity to provide for expansion and contraction. Its use insulates paving blocks and greatly decreases the noise of traffic.

Tarvia Mastic Filler, is a special grade of paving pitch for use with hot sand for wide joints in brick and wood pavements and for narrow joints in stone pavements.

The method of application is described and is illustrated by halftones of the work in progress and the equipment required for various kinds of pavement, and users are cautioned not to overheat the pitch, not to use coarse, cold, or damp sand with it, and not to let water get into the tar kettle.

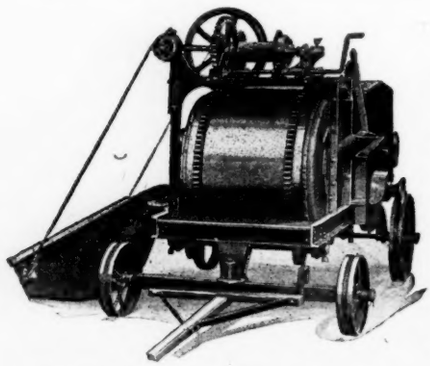
AMERICAN LA-FRANCE FIRE ENGINE CO.

The American La-France Fire Engine Co. Inc., announce the shipment during July of 39 pumping engines and cars to Japan and to points in 17 different states. They also announce the sale during the same of 20 similar pieces of equipment to different cities in the United States, ten of these sales being repeat orders.

KOEHRING CONSTRUCTION MIXER

Under this title the Koehring Machine Company has issued catalog No. 22, containing nearly one hundred pages illustrating and describing concrete mixers and other equipment for building construction purposes.

Special attention is given to a detailed explanation of the three distinct actions involved in the concrete mixing and the operation of the discharge mechanism that effect a remixing process to which the high strength of test cubes made from concrete mixed in these machines is attributed. It is also due to the measurement and control of the amount of mixing water by the automatic measuring tank and to the regulation of time by the batch meter.



DANDIE 104-S MIXER; 4 FT. CAPACITY; GASOLINE ENGINE

The principal features and details of the machine are clearly described with special reference to design and operation of the discharge chute, drum track and drive, framework and truck, charging skip, centralized control, and ample boiler and engine capacity for steam, gasoline or electric service.

Specifications and illustrations are given of mixers with rated capacities for 28, 21, 14, 10, and 7 cubic feet of wet mix. A convenient table is given showing the quantities of cement and aggregate required for one batch for each of the five sizes of machines and for either of nine ordinary proportions of concrete or for a 1:6 mixture of cement and gravel.

There are also very clear and specific instructions for the operation of the construction mixers and for the adjustment and operation of the water measuring tanks.

Besides the construction mixers above noted, the catalog gives complete data of the Dandie mixer, a portable machine of light weight and reliable construction made in two sizes with capacities of 4 or 7 seven cubic feet of mixed concrete per batch and capable of accomodating 6 and 10 feet respectively of unmixed material, and of discharging heavy concrete in 10 to 12 seconds and sloppy concrete in 15 to 17 seconds.

These machines are convenient for small work and for special service on large mixers. They are operated by Fuller & Johnson gasoline engines, have dust proof bearings wherever possible, and are designed with a low charging arrangement permitting the machine to be supplied direct from wheelbarrows when necessary, although pivoted charging skips are supplied. An auxiliary friction hoisting drum is also supplied if ordered for light service such as elevating concrete, timber, or mortar in buildings.

The catalog contains convenient tables showing the quantity of concrete for 1-inch slabs with dimensions up to 12½ x 22 feet; quantity of concrete in beams, girders and columns from 8 to 36 inches square and from 4 to 36 feet long; the quantity of concrete in footings from 1½ to 12 feet square and 28 inches to 30 inches deep; the amount of screened 1-inch stone and of screened and unscreened 2½-inch stone and of ¾-inch gravel required for 1 yard of rammed concrete in any one of more than 40 varying propositions.

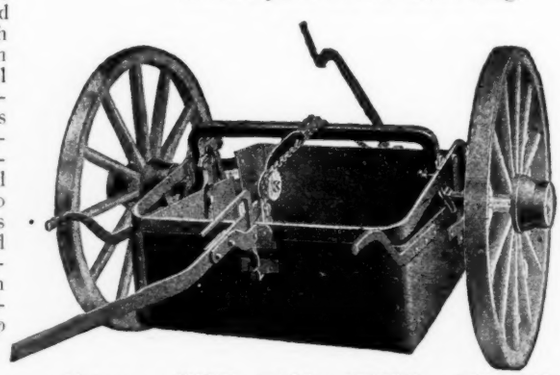
YOURS, FOR GOOD ROADS

An illustrated 40-page pamphlet entitled "Yours For Good Roads" and issued by the Smith & Sons Mfg. Co. in the interest of Royal road machinery, illustrates and describes wheel scrapers with special fore-truck and pan-hook attachment and adjustable skein. It also illustrates various types of buck, tongue and drag scrapers, the Monarch road drag with detachable blades, railroad and township reversible road graders, new highway traction graders, Royal rock crushers, and Royal reversible road rollers.

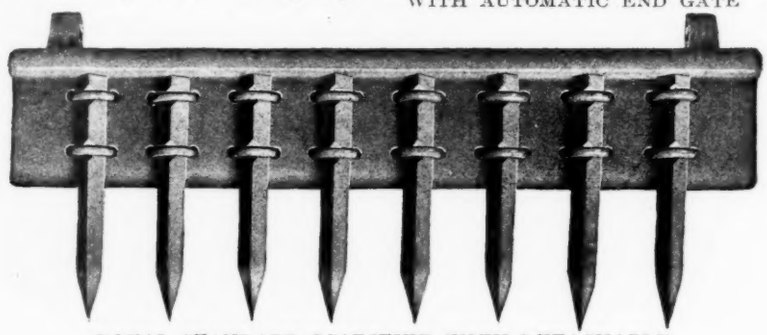
The Royal standard reversible road grader has an extra long draw beam that keeps the blade in the ground better and makes the grader run steadier. The 7-foot adjustable blades are capable of being extended to a length of 9½ feet for embankment work, thus requiring less power and giving greater economy in operation.

The circle for the revolving blade is made of high carbon steel with teeth specially cut to fit the reverse worm gear by which it is easily and quickly operated.

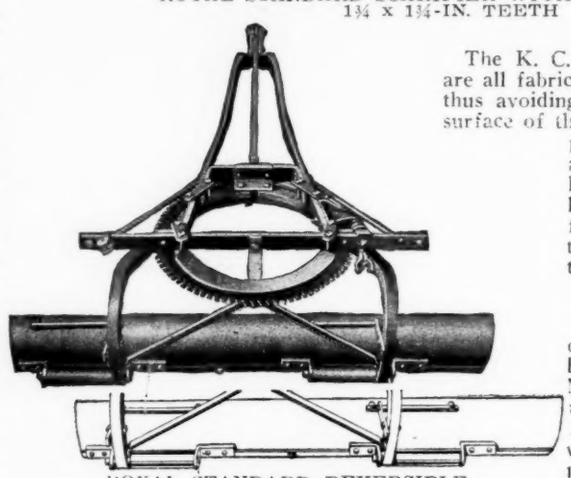
The Royal standard scarifier is an attachment interchangeable on the Royal standard or Royal special engine grader and has eight teeth made of tool steel strongly anchored by two U-bolts to the heavy cast iron beam. It weighs 600 pounds, and has teeth 1¾ inches square and 18 inches long.



HIGH BALL WHEEL SCRAPER WITH AUTOMATIC END GATE



ROYAL STANDARD SCARIFIER WITH DETACHABLE 1¾ x 1¾-IN. TEETH



ROYAL STANDARD REVERSIBLE ROAD GRADER WITH EXTENSION BLADE ADJUSTMENT

The K. C. Highball wheel scrapers are all fabricated without hot bending, thus avoiding injury to the hardened surface of the special steel. They are provided with automatically working end gates and have a new draft hook lug on the pan made in the form of a continuous loop that avoids difficulty from the opening of a hook lug.

JACOB LOWENSTEIN

Jacob Lowenstein has opened an office in the Equitable Trust Building, New York City, as consulting engineer and for technical knowledge service and for services in purchase of steel for buildings, bridges and other structures.